2019 Science and Technology Research Projects

Use of Novel Parasites to Control Naive North American Dreissenid Populations, Funding: $150,000

In this project, populations of North American quagga and zebra mussels (Dreissena rostriformis bugensis and D. polymorpha) are being evaluated in the laboratory for their "naïveté" to closely related parasites that normally infect only "cousin" Dreissena spp. -- dreissenid species whose evolution diverged from zebra and quagga mussels millions of years ago. Our goal is to identify these parasites, evaluate them, and one day have a new and novel biocontrol agent for quagga and zebra mussels.

Additive Manufacturing Investigation and Demonstration for Hydropower Applications, Funding: $200,000

Can additive manufacturing (AM) be used to lower O&M lifecycle costs for unique/custom parts and equipment? Until recently, AM processes have been characterized by relatively low production rates and high feedstock costs. As technology has improved, the economics have begun to shift to include larger sized applications and lower value parts. Hence, an economic / life cycle cost analysis should be performed for each potential use case identified in the study. It is possible that a high impact part such as a turbine runner could be considered for demonstration in the later phases of the project. What are the limitations of current AM technology and materials (both technical and practical) as they relate to hydropower applications?

Developing a Collaborative Environment for Sharing Geographic Information Systems Data Between Reclamation and Irrigation Districts, Funding: $18,000

Utilizing existing ESRI technologies, can a GIS collaborative environment between Irrigation Districts and Reclamation be developed and transferable processes be documented and utilized simplifying the effort necessary when developing other collaborative environments?

Alternate Control Strategy for Dreissinids Using Electrical Methods, Funding: $58,440

Can electrical control methods be used for the environmentally neutral mitigation of zebra and quagga mussel macrofouling in Reclamation facilities?

Reclamation Interactive Visualization and Exploration Resource (RIVER): A model scenario visualization tool for RWIS/RISE, Funding: $100,000

How can Reclamation provide opportunities for both internal users and external stakeholders to better utilize Reclamation’s modeling results in ways that support decision-making? We propose to support access to and engagement with Reclamation’s modeling results by building an interactive web platform, utilizing JavaScript on the RISE visualization server, that will allow users to visualize and compare various modeling scenarios in both map and graphic form.

Rotor Installed Corona Mapping of Stator Windings within Large Diameter Hydro Generators, Funding $56,280

Previous work has shown that existing technology (near field communication (NFC) antennas) from other industries can be leveraged to obtain partial discharge measurements of a stator coil from within a simulated air gap. Can reliable measurements be taken from within actual machines, over entire stator windings, with localization resolution to a specific coil or coil group, without removing the rotor?

PCCP Inspection Truthing and Educational Demonstration, Funding: $111,882

This research will have two primary goals: (1) perform a thorough forensic analysis on the distressed PCCP and compare it to the results reported from EM inspection, and (2) install the distressed pipe section in the Materials and Corrosion Laboratory in Denver to be used as an educational tool for training Reclamation staff.

Facility Management of Reclamation's Dams - O&M Integration of the Unified Intelligent Model, Funding: $75,000

A unified intelligent model of Glen Canyon dam and powerplant includes point vloud, photogrammetric and the general layout of Building Information Modeling models. This proposal seeks to determine if additional model development and connection of the BIM models to CARMA can streamline facility design, O&M and work order processes and activities?

Improving seepage measurements in the Truckee Canal and developing a framework for data collection, modeling and assessment of unlined canal seepage, Funding: $121,950

How will the evaluation of diffuse and point seepage increase the reliability of the Truckee Canal operations model? Can this be tied to other seepage monitoring work in the Truckee Canal? How can a full seepage model for a canal be developed using a variety of monitoring techniques? What is the optimum type of monitoring system for other water conveyance or storage projects?

Field Implementation of Burrowing Animal Deterrents for Earthen Canal Embankments, Funding: $58,408

Can wind-powered acoustic emitters, metal mesh liner with noxious plants, or some combination of the two be used to sustainably and cost-effectively deter animals from burrowing into earthen canal embankments?

Algae Resistant Linings for Canals and Other Water Resource Structures, Funding: $83,520

Can chemical and physical characteristics of concrete surfaces inhibit algae growth on canal linings and other water resource structures? An understanding in the correlation between the nature and composition of concrete with its biological characteristics would improve operation of Reclamation’s water delivery facilities and have numerous environmental and safety benefits.

Aging Reservoirs, Climate, Operations, and Potential Cumulative Impacts to Water Quality, Clarity and Fisheries and Recreation, Funding: $70,500

Can Reclamation develop a set of tools and techniques that will allow researchers to gain a better understanding of benthic turbidity layers, their composition, what causes them, and why in some areas have they only recently been observed? If this is potentially becoming a bigger problem, and if we can describe the cause, can we identify other reservoirs that are likely susceptible to this same phenomenon over time, and through mechanistic and modelling approaches provide solutions for Clark Canyon and other reservoirs?

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Fish Passage at River Diversion Juncture: A Science-Based Approach, Funding: $50,000

The proposed research is to develop a science-based approach for design and evaluation of alternatives that may enhance fish entrainment or reduce fish passage through a diversion channel at a river juncture. Downstream migrating juvenile salmon will be the target.

Comparison of traditional and new testing methods for riprap material quality, Funding: $37,280

How do traditional riprap testing methods, based on testing 3/4-inch minus crushed material, compare to newer methods based on testing 2-inch thick slabs of design size blocks? This research will perform side-by-side comparisons of the two methods on identical samples to answer this question. Results will be used to inform design standards and construction specifications.

Investigating Techniques for Sealing Small Leaking Cracks in Concrete Sections, Funding: $58,000

What are effective methods and materials to seal small leaking cracks in concrete sections without causing damage to the structure?

Refining Quagga Habitat Suitability Models, Funding: $25,000

This project will assess how current habitat suitability models may be refined to more accurately inform risk assessment in Reclamation waters. Data from the dreissenid early detection database will be used to select waterbodies of interest and the findings of this research will be used to inform strengthen the predictive model currently in development in partnership with the US Army Corps of Engineers.

Fusion of in-situ soil moisture and remotely sensed data, Funding: $6,200

Does soil moisture variability significantly affect multi-spectral and lidar signal parameters and can any effect(s) be integrated into analyses of imagery which overlaps, and extends beyond, the location of monitoring instruments? Similarly, can local soil moisture data be used to enhance the spatial resolution and accuracy of data products derived from satellite platforms such as those produced by NASA's Soil Moisture Active/Passive (SMAP) mission?

Invasive Mussel Literature Resource, Funding: $16,000

Invasive quagga and zebra mussels present a significant risk to Bureau of Reclamation operations and infrastructure. They have the potential to disrupt Reclamation operations and to cause damage to infrastructure leading to expensive repairs. A number of initiatives are currently underway at Reclamation to look at invasive mussels, including their spread, their economic impact, and potential methods for

control in Reclamation infrastructure and open water environments. A centralized resource for accessing scientific literature and reports on invasive mussels will serve as a resource for these and other projects.

Characterizing novel supplementary cementitious materials to reduce infrastructure costs and improve durability, Funding: $27,400

Can new alternative supplementary cementitious materials be identified and used to improve cost and performance of concrete infrastructure?

Demonstration and Use of Advanced 3D Measuring Techniques using Portable Laser and Arm Technology, Funding: $256,000

Can Reclamation gain a powerful new toolset and knowledge base to three-dimensionally map componentry and equipment, with high-accuracy and speed, while subsequently reducing maintenance and repair costs through time-savings and an expansion of in-house capability?

Econometric Analysis and Forecast Model for Reclamation Corrosion Protection Costs, Funding: $108,500

The primary research questions are: What are the major cost drivers for the protective coating contracts, and how are they impacted by facility-specific variables, i.e., structure type, access, repair area, percentage of structure being repaired, etc.? How can Reclamation appropriately budget for future corrosion protection expenses?

Viral Treatment for Harmful Algal Blooms: A Preliminary Inquiry, Funding: $20,000

This project will investigate the research that has been done on virus-like particles that infect algae and cyanobacteria that cause harmful algae blooms. A literature review will be done to assess the current state of research, and identify the areas in which more research is needed to facilitate the development of VLP based treatments for HABs. A case study will also be done to determine the extent and context of the HABs that are occurring.

Evaluation of corrosion inhibitive coatings, Funding: $104,031

Is there a commercially available inhibitive-type coating system that delivers similar performance to the modern-day systems that we currently specify? Modern inhibitor coatings have been largely untested by Reclamation, and it is unknown how they would compare to Reclamation's barrier coating systems and legacy systems.

Uplift Pressure and Flow through Open Offset Joints in Spillway Chutes, Funding: 72,600

Can uplift pressures and flow rates through open joints and cracks in high-velocity spillway chutes be related to a characteristic boundary layer velocity, instead of the depth-averaged mean velocity? Previous tests in short flumes with no significant boundary layer (uniform-velocity flumes) have related uplift pressures to the mean velocity. New testing in a "boundary layer flume" could show that uplift pressures are significantly lower due to boundary layer effects.

Development of a Chimeric Biopesticide for the Treatment of Zebra and Quagga Mussels, Funding: $40,000

Currently, no approved treatments of zebra and quagga mussels provide effective eradication strategies in open water. There are currently no biopesticides utilizing immunotoxin technology for the remediation of aquatic nuisance species. Engineered toxin body (ETB) and Immunotoxin technologies are well validated in human health applications and can be utilized for environmental application. Production of such

biopesticides in commercial micro-algae production vectors offer a low cost, high yield solution. This approach lowers the risk of unintended harm to native ecologies, lowers production cost, and requires a lower effective dose than previously approved biopesticides.

Feasibility of Autonomous Robotics for Relining Penstocks and Similar Structures, Funding: $139,000

Can autonomous robotic coatings applications become the new method for relining penstocks and similar equipment at Reclamation? Should the robotic equipment be optimized for legacy coating application via solution vinyl?

Occurrence of Organic Micropollutants in the San Juan River in Northwest New Mexico and their Removal during Drinking Water Treatment, Funding: $86,750

What is the spatial and temporal occurrence of organic micropollutants and per- and polyfluoroalkyl substances in the San Juan River Cutter Reservoir in northwest New Mexico? Which commercially available GAC products are most effective at removing OMPs and PFAS following conventional drinking water treatment? How do seasonal changes in SJR and CR background dissolved organic matter (DOM) impact OMP and PFAS removal?

Development and Field Research on Next Generation Coatings for Mussel Mitigation on Infrastructure, Funding: $50,000

Can new technologies be developed and scaled up to commercialization that have foul release properties, preventing attachment of quagga and zebra mussels, while maintaining durability protecting infrastructure? Pacific Northwest National Laboratory and U.S. Army Corps of Engineers will be researching and developing new durable foul release coatings. Reclamation will provide support by sharing its knowledge and expertise it has learned during its past 10 years of researching foul release coatings and Reclamation will provide a site for field testing.

Improved Prediction of Seismically Induced Hydrodynamic Loads on Dams and Spillway Gates, Funding: $80,000

A more accurate solution is needed to predict hydrodynamic loads on spillway gates induced by seismically activity. Current methods use simplified hydrodynamic and inertia assumptions which can lead to over or under design of new gates, unnecessary modifications to existing gates and unreliable risk assessment guidelines. Results from this research will add to the 2018 study and further decrease uncertainty in assumptions and improve design guidance by using physical hydrodynamic data in conjunction with numerical FEA tools.

Leverage Existing Environmental Data for Improved Usability by Standardization and Migration to RISE-Compatible Database, Funding: $117,546

The Mid-Pacific Region's Division of Environment Affairs database of over 600,000 environmental records is not currently compatible with Reclamation Information Sharing Environment and cannot easily be discovered and used for reporting, management decisions, or research. MP-150 will standardize this data and migrate it to a new, enhanced database that will vastly improve its data integrity, security, and usability. In the enhanced database, stakeholders will be able to find data across multiple programs and integrate data with geographic information system (GIS) technologies. Data will also become compatible with RISE, allowing data to be easily discovered and accessed by the American public.

The potential for restoring thermal refugia for cold-water fishes, Funding: $28,152
What is the potential for stream and floodplain restoration for cooling water temperatures and creating thermal refugia in rivers? What restoration techniques are effective at cooling surface water temperatures?

Reclamation Detection Laboratory for Exotic Species (RDLES), Funding: $300,000
The goal of this research is to continue to develop RDLES laboratory methodology and support participation in nation-wide collaborative efforts related to dreissenid mussel detection and control. The data and capabilities provided by RDLES will support a variety of other Research Office funded projects that aim to understand the projected spread of invasive mussels based on environmental parameters and conditions in the western United States.

Feasibility of Utilizing Optical Instrument Transformers in Reclamation Power Facilities, Funding: $64,458
Are optical instrument transformers a viable and better option to replace conventional instrument transformers in Reclamation electrical equipment? It is hypothesized that converting from the use of convention instrument transformers to optical transformers will provide major benefits to field operations in terms of cost, accuracy, installation, testing, and safety.

Reduction of Damaging Stator Core and Winding Vibrations in Large-Diameter Salient-Pole Synchronous Machines, Funding: $214,639
Is it possible to substantially reduce harmful vibrations and noise caused by less-than-adequate electrical design of the stator winding and core without replacing major components?

Quantifying Fish Biomass X Distance from Environmental DNA Samples in a Hydrodynamically Complex Environment, Funding: $87,372
Can monitoring of Environmental DNA (eDNA) in hydraulically dynamic systems be used as a tool for monitoring target species to facilitate optimization of water delivery operations? Our specific research question will investigate how much fish biomass X distance is present when a quantity of DNA is obtained in a water sample.

Polysiloxane and Vinyl coatings Comparison and Field Trial, Funding: $118,000
Are any of the polysiloxanes a close vinyl replacement? Initial laboratory tests show similar properties, but are not entirely identical to vinyl. Additional laboratory testing is required to identify better primers or if direct to metal applications will be closer to the results of vinyl. It is recognized that laboratory test is not the same as a field test, but laboratory tests should be used to screen products to determine if there are any major problems prior to doing a field test.

Tools to Support Design of Coanda-Effect Screens for Debris Exclusion and Fish Protection, Funding: $40,000
Can the flow capacity and associated profiles of flow conditions (depth, velocity, etc.) over Coanda-effect screen structures be predicted analytically for the range of screen slopes, flow conditions, and screen materials encountered in typical applications? Can analytical methods for screen capacity estimation be documented and disseminated via journal articles and a user-friendly computer program that will assist screen designers?

Technology Transfer: Developing Tools for Efficient Handling of Data for Hydraulic Modeling and Habitat Analysis, Funding: $22,400

How can computer programs developed for processing hydraulic modeling results and conducting habitat analyses be packaged into tools that will improve workflow processes?

Bio-physical Integrated Land Atmosphere Water Simulator (BI-LAWS), Funding: $80,000

Reclamation and other developers will be able to modify and extend the BI-LAWS model as new understanding of plant-atmosphere interactions and methods of representing them efficiently in models advance. In addition, Reclamation has identified the need for forecasts, especially ensembles, to characterize uncertainty along with the need to effectively share such information with technical, managerial and stakeholder communities. BI-LAWS will address all of these needs by developing an open source BI-LAWS model; incorporating it into WwET4Cast workflow and providing access to data and BI-LAWS results through the RISE platform.

Effects of Water Absorption on Epoxy-Mica Based Stator Winding Insulation Systems, Funding: $65,000

How does varying types of water exposure affect stator winding insulation properties and ultimately does it reduce the expected service life of the winding?

Improving volume forecasting tools for snow dominated basins, Funding: $33,000

This project will attempt to answer two key questions: 1: Do the statistical volume forecasts developed by the PyCast Forecasting tool improve the ability of reservoir operators to manage runoff to reduce flooding potential and maximize refill potential? 2: Does seasonal, statistically based forecast skill improve by incorporating remote sensing products of snow and snow water equivalent?

Seepage Detection and Characterization in a Truckee Canal Site using L-band Synthetic-Aperture Radar (SAR) Technology, Funding: $113,800

Can SAR satellite remote sensing technology serve as a new enhanced seepage detection technique for identification of potential seep locations at canal embankments and levees?

Side channel evolution and design: achieving sustainable habitat for aquatic species recovery, Funding: $78,680

How do side channels form and evolve in both sand and gravel bed river systems? A sustainable side channel is one that is able to maintain habitat function over time, either as a single channel or as part of a network within a floodplain. Though a sustainable channel may evolve over time, the biological, geomorphic, and hydraulic characteristics will continue to provide intended habitat function.

Concrete Fabric for Concrete Canal Lining Repairs, Funding: $30,000

Can concrete cloth be used on Reclamation canals as a repair product for small spot repairs or as a lining for small canals to reduce outage time and reduce construction costs?

Evaluation of Active and Passive Thermography for Rapid Detection and Characterization of Concrete Infrastructure Defects, Damage, and Deterioration, Funding: $30,000

Can active heat-pulse or passive thermography be implemented in a manner that is technically and economically feasible for rapid and effective detection and imaging of concrete structure defects/damage/deterioration in a field-scale implementation scenario? What is a reasonable spatial resolution and

reasonable depth of investigation (DOI) limitation for thermal tomography on concrete? What are some of the main limiting factors in DOI?

Improving predictions of scour in the vicinity of vegetation in habitat rehabilitation areas, Funding: $22,400

How can ecohydraulic modeling capabilities be improved by enhancing capability to predict scour in support of habitat and riparian rehabilitation projects?

Side channel evolution, geomorphic diversity, and sediment transport on the Bighorn River following larger dam releases between 2008 and 2018, Funding: $65,280

How do model predictions of sediment transport compare with direct measurements of sediment transport from tracer particles? Are restored side channels sustainable in stream systems with regulated hydrology? How have higher flow releases in recent years affected the geomorphic diversity and stream morphology? Previous studies indicated that the lack of high discharge releases likely led to a loss in geomorphic diversity. However, locals residents and shareholders are concerned such releases have led to an increase in erosion. Is recent erosion significant in terms of historic trends or a part of natural river migration processes (i.e. is recent erosion occurring within historically dynamic areas of the channel morphology)?

Investigation of Electrochemical Noise Method for Coating Field Assessments, Funding: $30,000

Does the Electrochemical Noise Method (ENM) produce field coatings data that is comparable to that achieved through Electrochemical Impedance Spectroscopy?

Evaluation of Laser Doppler Vibrometry for Long-Range Remotely-Sensed (Touch-Free) Seismic Data Acquisition, Funding: $30,000

Can LDV be implemented in a manner that is technically and economically feasible for rapid and effective collection of remotely-sensed (e.g., touch-free) seismic data for the sake of detecting and imaging concrete structure defects/damage/ deterioration in a field-scale implementation scenario? What are the main technical and practical capabilities and limitations for LDV to replace standard seismic surveying techniques on large concrete structures? What replacing or augmenting standard seismic surveying techniques on earthen surfaces or earthen structures?